REPORT
ON
A HYDROGEOLOGIC INVESTIGATION
IN THE RURAL HAMLET OF
ALFRED HARRIS GARDENS
CITY OF BURLINGTON

M O R R I S O N B E A T T Y L I M I T E D
4500 Dixie Road
Mississauga, Ontario
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NOVEMBER, 1982
PROJECT NO. 308-821

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November 10, 1982

The Regional Municipality of Halton,
Public Works Department,
P.O. Box 7000,
1151 Bronte Road,
Oakville, Ontario.
L6J 6E1

Attn: Mr. R.B. McMurray, P.Eng.
Supervisor, Budget & Development

re: Hydrogeologic Investigation
for the
Hamlet of Alfred Harris Gardens
City of Burlington
Your File No. PR-687
Our File No. 308-821

Dear Mr. McMurray:

As requested, we have completed a hydrogeologic investigation in the Hamlet of Alfred Harris Gardens. We are pleased to present to you at this time, our final report which presents the findings of our investigation and our conclusions and recommendations with respect to future development within the study area.

Yours very truly,
MORRISON BEATTY LIMITED

William D. Banks, B.Sc.(Eng.)

WDB/jo

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1.0 INTRODUCTION

At the request of Mr. H.H. Cripps, P.Eng., of the Regional Municipality of Halton Public Works Department, we have completed a hydrogeologic investigation for the Hamlet of Alfred Harris Gardens in the City of Burlington. A topographic location of the study area is shown in Figure 1.

The purpose of our investigation was to determine the adequacy of long term groundwater supply to support existing and new development in this hamlet without detriment to existing ratepayers. A secondary purpose of the investigation was to determine the suitability of the local soils to absorb domestic sewage. The objectives of this study are detailed in the Terms of Reference which are enclosed in Appendix A.

Our investigation included a review of available maps and reports relating to the local pedology, surficial geology, hydrogeology, and hydrology. This information was augmented by discussion with the Ministry of the Environment, meetings with the Regional staff, a house to house survey for the purpose of identifying current and past individual well water quantity and quality problems, and discussions with representatives from the Nelson Quarry. A general inspection of the study area and the excavation of test pits were also included in our field investigation.

Following a discussion of the findings of our investigation, conclusions are drawn and recommendations are made with respect to future development within the Hamlet of Alfred Harris Gardens.

1.1 Acknowledgements

We wish to thank the staff of the Regional Municipality of Halton, the City of Burlington, the Ministry of the Environment, and all of the local residents for their assistance during this study. We also wish to thank Mr. D. Ashwell of Genstar Stone Products Inc. for his assistance, during our discussion on June 29, 1982.

A special thanks is included to Mr. H.H. Cripps, Mr. G. Sullivan, and Mr. R. McLean.

2.0 GEOLOGY

2.1 Overburden

2.1.1 General Description

The overburden within the study area and throughout much of the surrounding area has been previously mapped as the Halton Till. This till is of late Pleistocene age (approximately 10,000 to 30,000 years) and was deposited by thick continental ice sheets advancing out of the Ontario basin. The Halton Till is described as being a purplish, moderately stony, clay or silt till. Records of water wells indicate the overburden is less than 5.0 m throughout much of the study area. Previous mapping has identified bedrock outcrops in the area of the intersection of Cedar Springs Road and No. 2 sideroad and in several locations south of the intersection. Bedrock outcrops have also been identified along the east bank of the Medad ravine which forms the west boundary of the study area. Bedrock has been exposed as a result of excavation where Colling Road intersects Cedar Springs Road. The Nelson Quarry of course, provides the most complete picture of bedrock stratigraphy in the area.

Wells penetrating 12 to 18 m of overburden are reported immediately northwest of the study area. These wells are located on the infilled flanks of the Medad ravine, which has been identified as a tributary to a bedrock reentrant valley of the Niagara Escarpment. Bedrock valleys were partially filled with glacial deposits during the last ice advance through the area and as a result, the depth of overburden is often greater in the valleys than in surrounding areas.

A review of the agricultural soils mapping indicated the presence of two soil types within the study area. The predominant soil type has been identified as the Guelph loam, which is described as being a well drained, moderately stony, sandy loam till with a complex topography. The other soil type identified in the area is the London loam which is located almost within the confines of the Burlington Springs Golf Club and in a few small areas in the southern end of the study area. The London loam has been described as an imperfectly drained, moderately stony, loam till with a simple topography.

As a result of the shallow depth of overburden within the study area, the bedrock is a major influence on the surficial topography. Relief within the study area is approximately 20 m.

2.1.2 Test Pits

Test pits were excavated as part of the field investigation, for the purpose of a preliminary assessment of soil characteristics within an area where development is proposed. A total of four test pits were excavated and the locations are shown in Figure 2. Soil samples were collected from three of the test pits for grain size analyses. The resulting grain size distribution curves are presented in Figures 3a to 3d.

2.2 Bedrock

The study area is located west of the Niagara Escarpment and the bedrock within this area consists of Lockport/Amabel dolomite. This formation overlies the Clinton and Cataract Groups which in turn overlies the red shales of the Queenston Formation. These bedrock units range in age from Middle and Lower Silurian to Upper Ordovician (about 430 to 450 million years). All these formations dip gently to the southwest at about 4 to 5 m/km.

The Lockport/Amabel dolomite has been described as showing considerable variation in bedding, texture and colour from place to place. It is described as essentially a thick series of magnesium limestone or dolomite, commonly light grey to bluish, fine to coarsely crystalline and in places quite porous. It is deposited in beds 0.6 to 1.2 m thick with both thicker and thinner beds locally developed. Because of these inherent characteristics the Lockport/Amabel Formation is recognized as being capable of providing abundant supplies of potable water. A profile showing the bedrock formation and the dip on the beds is shown on Figure 4.

3.0 HYDROLOGY AND HYDROGEOLOGY

3.1 Surface Water

Drainage of much of the study area is provided by two streams. There is one stream which originates as two branches within the study area. One branch begins in the south-central part of the Burlington Springs Golf Club. There is a large irrigation pond on the Golf Course which the stream apparently drains. The other branch rises to the northeast of the first and flows to the northwest. The branches meet at Colling Road and the stream continues to the northwest for approximately 3.0 km, then veers to the southwest and drops rapidly to the base of the Medad ravine where it joins a tributary of Bronte Creek. This stream is reportedly intermittent during the dryer months of the summer.

Another stream originates to the northeast of the hamlet, just to the south of the Nelson Quarry. The stream has been dammed in several locations south of No. 2 Sideroad to create several ponds. The stream flows to the southeast, passing by the southeast section of the study area and continues to flow southerly eventually joining Grindstone Creek.

Surface water streams and ponds within the study area and the surrounding area are shown in Figure 5.

A seasonal drainage problem has been reported on the south side of No. 2 Sideroad, west of Cedar Springs Road. Flooding occurs every spring on two adjoining lots; 1316 and 1328 along No. 2 Sideroad. These two lots are situated in a topographically low area and water collects during periods of snow-melt. Drainage of the ponded water is apparently provided by a drain pipe which runs below ground to the north. The pipe empties into a ditch, located in the empty lot behind 5106 Cedar Springs Court. The ditch ends at the crest of the Medad ravine.

3.2 Groundwater

3.2.1 Groundwater Movement

Copies of water well records, on file with the Ministry of the Environment, were obtained for the purpose of establishing the characteristics of the regional bedrock aquifer. Logs of selected water wells located within the study area are presented in Appendix B.

A groundwater contour map was developed from a plot of static water level elevations of local wells (Figure 6). This map shows the direction of groundwater movement through the bedrock aquifer to be to the southwest. The lateral movement of groundwater is illustrated on three geologic profiles of the study area (Figures 7, 8, and 9). Groundwater discharges to the Medad ravine as springs from bedrock outcrops along the east bank.

There is no evidence of either an upward gradient of groundwater movement or a confining layer within the bedrock sequence. Infiltrating precipitation therefore moves downward under the influence of gravity within the overburden towards the bedrock aquifer.

3.2.2 Groundwater Recharge

The average annual precipitation for this region of Southern Ontario is reported to be 76 cm (30"). Based on this rate and the characteristics of the overburden within and around the study area, the average annual infiltration has been conservatively estimated to be 13 cm (5"). Applying this total infiltration to the study area (approximately 260 ha) results in a recharge rate of 3560 l/d/ha (310 gpd/acre). In addition to this recharge there is the return of water to the aquifer following treatment by means of septic tile beds. Underflow in the direction of groundwater movement will also increase the perennial yield of the aquifer.

3.2.3 Groundwater Availability

Records of water wells within the study area indicate water is obtained from drilled wells which penetrate the Lockport/Amabel dolomite. Pumping tests performed when these wells were installed show yields ranging from 10.0 to 136 l/min (2.25 to 30 igpm) with a mean yield of 61 l/min. (13 igpm) The range in specific capacity was determined from the pumping tests to be 0.8 to 76 l/min/m (0.1 to 5.0 igpm/ft.) with a mean specific capacity of 20 l/min/m (1.4 igpm/ft.). The range in available drawdown was determined from the well records to be 0.6 to 20 m (2 to 66 ft.) with a mean available drawdown of 6.0 m (20 ft.). This would indicate there is an abundant supply of groundwater throughout the study area for domestic purposes.

4.0 WATER QUALITY

4.1 Chemical

Water samples were collected from a selection of wells within the study area. All wells had been drilled and were completed in the dolomite aquifer. Samples were then submitted to the Ministry of the Environment for analysis of common chemical parameters. The results are presented in Appendix C.

The analyses indicate the total hardness of the groundwater in the local area is high. For this reason, many residents find it necessary to soften the water prior to use. The concentrations of total iron and sulphates were within the recommended limits for drinking water for all samples. The pH level was also acceptable for all samples. The concentration of total nitrates ranged from 0.1 to 12.0 mg/l for the samples collected. All but one sample had concentrations which are within the recommended limits for acceptable drinking water. Six of the nine samples show elevated nitrate concentrations. The chloride concentration ranged from 12.8 to 342.8 mg/l for the samples collected. The recommended limit for drinking water of 250 mg/l was exceeded in only one sample.

These analyses indicate the local groundwater is an adequate source of potable water.

4.2 Bacteriological

Water samples were collected and submitted to the Ministry of Health for bacteriological analysis. The analyses for total and faecal coliform for twenty-seven samples are presented in Appendix D.

The results indicate that ten of the samples were from sources which are unsafe for drinking. Specifically, sample numbers 1, 2, 5, 9, 11, 14, 16, 18, 25 and 26 had unsafe counts of total coliform and/or faecal coliform.

Total coliform bacteria are present in animal waste and sewage, but are also found in soil and vegetation. Coliform bacteria are an indication of contamination. The presence of faecal coliform indicates relatively recent contamination by human and/or animal wastes.

Although more than one-third of the samples indicated quality levels which were unsafe for drinking, it is believed these are linked to individual well construction problems as opposed to a regional aquifer contamination problem. Contamination can also occur as a result of inefficient septic tank and tile bed systems which may not be providing proper treatment of sewage. We advocate that all wells be constructed with 6 m (20 ft.) of steel casing grouted into place to prevent the migration of surface contaminants along the annulus of the casing. The well casing should extend at least 0.3 m (1 ft.) above ground and should be equipped with a sanitary well cap. All wells should be equipped with pitless adapters.

The analyses indicate the local groundwater is an acceptable source of potable water. Individual problems have been identified and each site should be thoroughly examined to determine the source of contamination. Corrective measures should be taken to prevent further contamination of a private water supply and groundwater in general.

5.0 FUTURE DEVELOPMENT

5.1 Water Supply

5.1.1 Individual Private Wells

The average daily water consumption rate for a rural subdivision has been estimated to be 450 litres (100 gallons) per capita. A household of four would therefore require 1800 litres (400 gallons) per day. An individual private well would be required to yield approximately 1.3 l/min (0.3 gpm) perennially to supply this volume. It is recommended that a well be capable of providing a perennial supply of 4.5 l/min (1.0 igpm). For peak periods, it is suggested that the well yield 13 l/min (3.0 igpm) for a duration of 1 hour.

Based on the reported well yields and available drawdown within the study area, a well drilled into the dolomite bedrock aquifer should provide an adequate supply of water for domestic purposes. It is anticipated that the water will be hard and may require softening but, will be suitable for drinking provided the well is constructed properly.

To prevent contamination in a drilled well ending in bedrock, the well casing should extend a minimum of 6.1 m (20 ft.) below ground surface. Also the casing should extend a minimum of 1.5 m (5.0 ft.) into the bedrock. The entire annulus between the casing and the drill hole should be pressure grouted from the bottom of the casing, back to surface. The casing should extend at least 0.3 m (1.0 ft.) above ground level and should be equipped with a tight fitted, and vented well cap. This general procedure prevents contaminants on the ground surface and within the overburden from entering the well.

Prior to approval of proposed developments planning to use private wells, test wells should be drilled and pumping tests should be performed. The purpose of this is to assess the quantity and quality of groundwater and to determine any possible interference effects with existing neighbouring wells.

5.1.2 Residential Lot Area

The local recharge rate to the bedrock aquifer has been estimated to be 3560 l/d/ha (310 igpd/acre). The minimum size of residential lots is determined by relating this rate to the water requirement per lot. The minimum area of any residential lot of either a subdivision development or individual severance should be 0.5 hectares (1.3 acres). This is required to sustain groundwater supplies and minimize well interference. The Ministry of the Environment provides guidelines indicating minimum separations between wells and property boundaries, septic tanks, tile beds, and houses. The necessary separations should be provided when lot dimensions are devised.

Prior to development, testing should be conducted to assess the site-specific aquifer conditions. This is important in areas which may be affected by dewatering operations at the Nelson Quarry. Testing is also required to determine the impact of development on existing wells.

5.1.3 Development Phasing

Provided that all lots are at least 0.5 hectares in area, the development of residential subdivisions and individual severances within the study area will not require phasing.

5.1.4 Communal Supply

Records of water wells completed in the area indicate there is an abundant supply of potable groundwater for individual domestic supplies. The dolomite bedrock aquifer appears capable of supplying a sufficient quantity of water for future development. Testing would be required to establish a communal supply of water to serve both existing and proposed development. A communal supply source would have to be located where the potential for contamination is minimal.

5.2 Sewage Disposal

The soil within the study area is generally suitable for the installation of conventional septic tank and tile bed systems. The depth of soil overlying bedrock is reportedly less than 5.0 m throughout the study area and bedrock outcrops have been identified in several locations. In areas where tile bed installations are proposed, testing should be conducted to establish the depth of the *in situ* soils. If the depth to bedrock is found to be less than 2.0 m, it is recommended that the developer import suitable soil to construct raised tile beds to provide a minimum separation of 1.5 m between the bottom of the distribution pipe and the surface of the bedrock. This recommended requirement is in excess of the Ministry of the Environment regulations. This is required to provide adequate treatment of the waste so that contamination of the bedrock aquifer is prevented. The adequate supply of groundwater should provide dilution of the nitrates concentrated in the wastewater. The dilution should maintain the concentration of nitrates within the maximum drinking water standard of 10 mg/l. It is recommended that acceptable tile bed systems be designed and installed by the developer, based on testing results, and be inspected by the Health Department prior to issuing building permits.

For the purpose of estimating the size of conventional tile beds, we have assumed an average percolation rate of 20 min/cm based on the soil characteristics of the local area and houses with four bedrooms. From Ontario Regulation 374/81 (Sewage Systems) under the Environmental Protection Act, the length of distribution pipe required would be 180 m using the above parameters. This represents a total tile field area of 328 m^2. Final design of any tile bed must be based on the percolation rate of the soil at the site of the proposed bed, the depth to bedrock, and on the anticipated wastewater flow. A suitable area should be provided on each lot for a reserve tile bed in the event the primary tile bed ceases to function properly.

Both the primary and reserve tile beds should be located such that distribution pipe clearances from wells, buildings or structures, property lines, lakes, rivers, ponds, streams, reservoirs and springs, are met as specified by Ontario Regulation 374/81.

In areas where it is necessary to construct raised tile beds in imported soil, the existing surface and sub-surface drainage may be altered. It is therefore recommended that suitable methods be developed to provide adequate drainage for both proposed lots and any existing lots which may be affected by the construction of raised tile beds. Suitable drainage plans should be developed as a condition for approval of each proposed development.

6.0 QUARRY IMPACT

The Nelson Quarry, owned by Genstar Stone Products Inc., is located adjacent to the eastern boundary of the study area. At present, operations are concentrated at the west end of the quarry. Excavation of the dolomite extends 15 to 17 m below the bedrock surface. Dewatering is required to facilitate removal of the bedrock. In 1981, the total volume of water pumped from the quarry was 1.84 x 10^9 litres (405 million gallons). This represents an average pumping rate of 3500 l/min (770 gpm). The water is pumped to the two streams which were previously described under the heading of Surface Water.

Removal of such a large quantity of water has a significant impact on the bedrock aquifer in the immediate area. The recharge of the aquifer in the northern half of the study area is reduced by such operations. The total impact of quarry operations on groundwater can not be determined without more detailed testing. The future extent of the quarry is at present unknown and final rehabilitation plans are also unknown. Therefore, the operations will continue to have an impact on the surrounding area.

7.0 CONCLUSIONS

1) Records of drilled wells within the study area indicate the only source of groundwater for domestic purposes, is the dolomite bedrock aquifer. Pumping test records indicate there was a more than adequate supply for domestic purposes.

2) The bedrock aquifer should be capable of providing a perennial supply of 4.5 l/min (1.0 gpm) and should yield 13.5 l/min (3.0 gpm) during peak periods using invidudual private wells for future development.

3) Testing would be required to quantify the availability of groundwater for communal supplies.

4) The natural quality of the groundwater throughout the study area is acceptable for domestic purposes. The water is hard and may require treatment by softening prior to use.

5) Recharge to the bedrock aquifer is largely dependent on direct infiltration of precipitation. It has been estimated that the sustained recharge is about 3560 l/d/ha (310 gpd/acre).

6) The minimum area of any residential lot of either a subdivision development or individual severance should be 0.5 hectares (1.3 acres).

7) Phasing of either residential subdivision development or individual severances is not required within the study area.

8) Restrictions will be necessary on any development in the areas in the vicinity of the Nelson Quarry because of the impact of dewatering operations.

8.0 RECOMMENDATIONS

Based on the above discussions and conclusions it is recommended that:

1) Residential development should be allowed on the basis of individual water and sewage systems.

2) All wells to be constructed should be drilled and equipped with a minimum of 6.0 m (20 ft.) of steel casing socketed a minimum of 1.5 m (5 ft.) into the bedrock and properly grouted back to surface.

3) All wells should be drilled by the developer and inspected by the Region of Halton, and approved prior to the issuing of building permits.

4) All new private sewage systems should be designed and installed by the developer, and be inspected and approved by the Health Department prior to the issuing of building permits.

5) The minimum area of any residential lot of either a subdivision development or individual severance should be 0.5 hectares (1.3 acres).

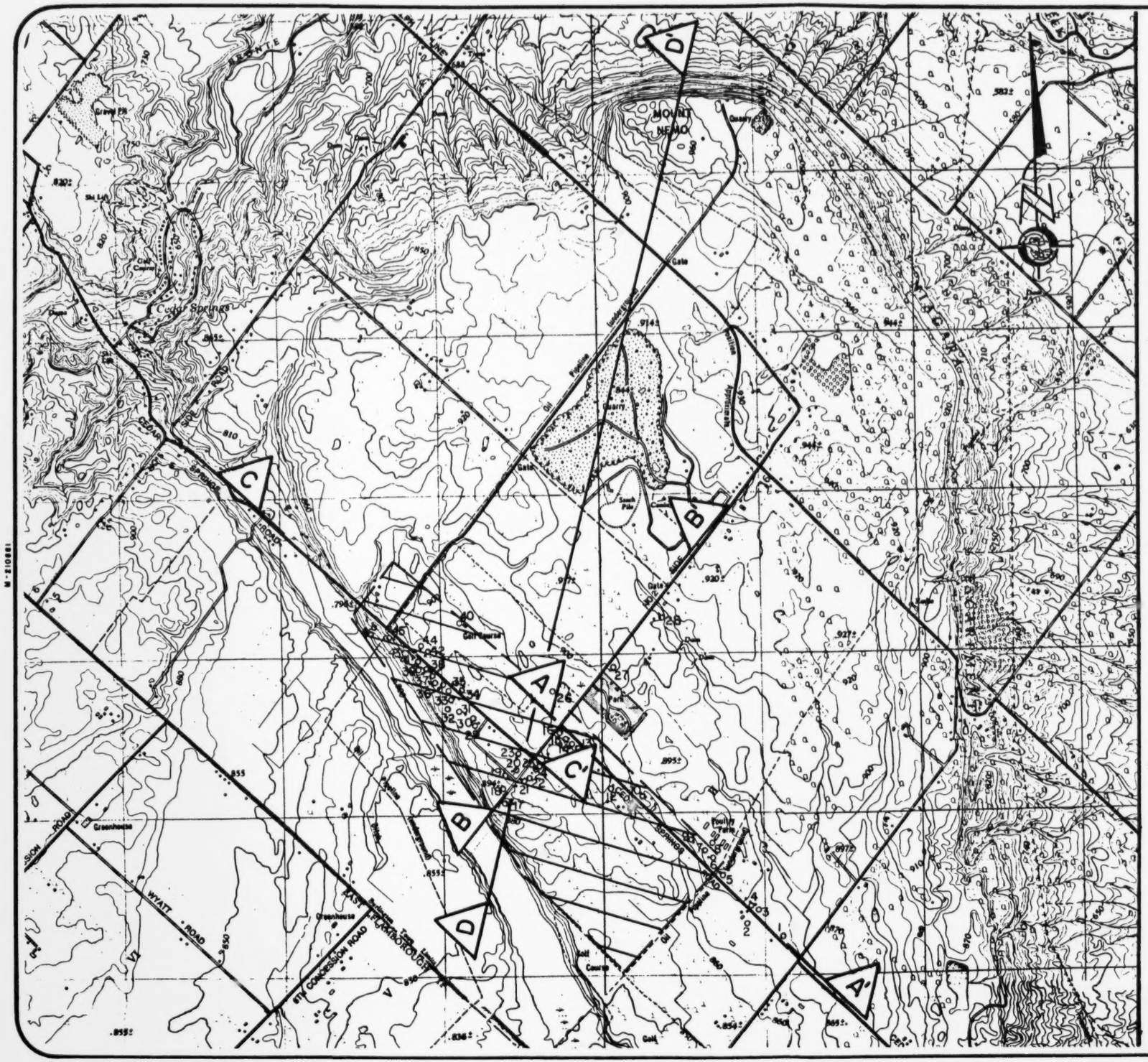
6) Secondary planning for the community be initiated, and incorporate the above recommendations.

Respectfully submitted,
MORRISON BEATTY LIMITED

W.D. Banks, B.Sc.(Eng.)

W.D. Morrison, P.Eng.

FIGURES



1 miles

SCALE 1:25,000

1000 metres

0 0

1000

LEGEND

A — LINE OF CROSS-SECTION

STUDY AREA

046 WELL LOCATION

Regional Municipality of Halton

Hydrogeological Investigation at the Hamlet of Harris Gardens, Burlington

TOPOGRAPHIC LOCATION

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morrison beatty limited consulting engineers and hydrogeologists	1

□4 Test Pit Location

Regional Municipality of Halton

Hydrogeological Investigation at the Hamlet of Harris Gardens, Burlington

TEST PIT LOCATION

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morrison beatty limited consulting engineers and hydrogeologists	2

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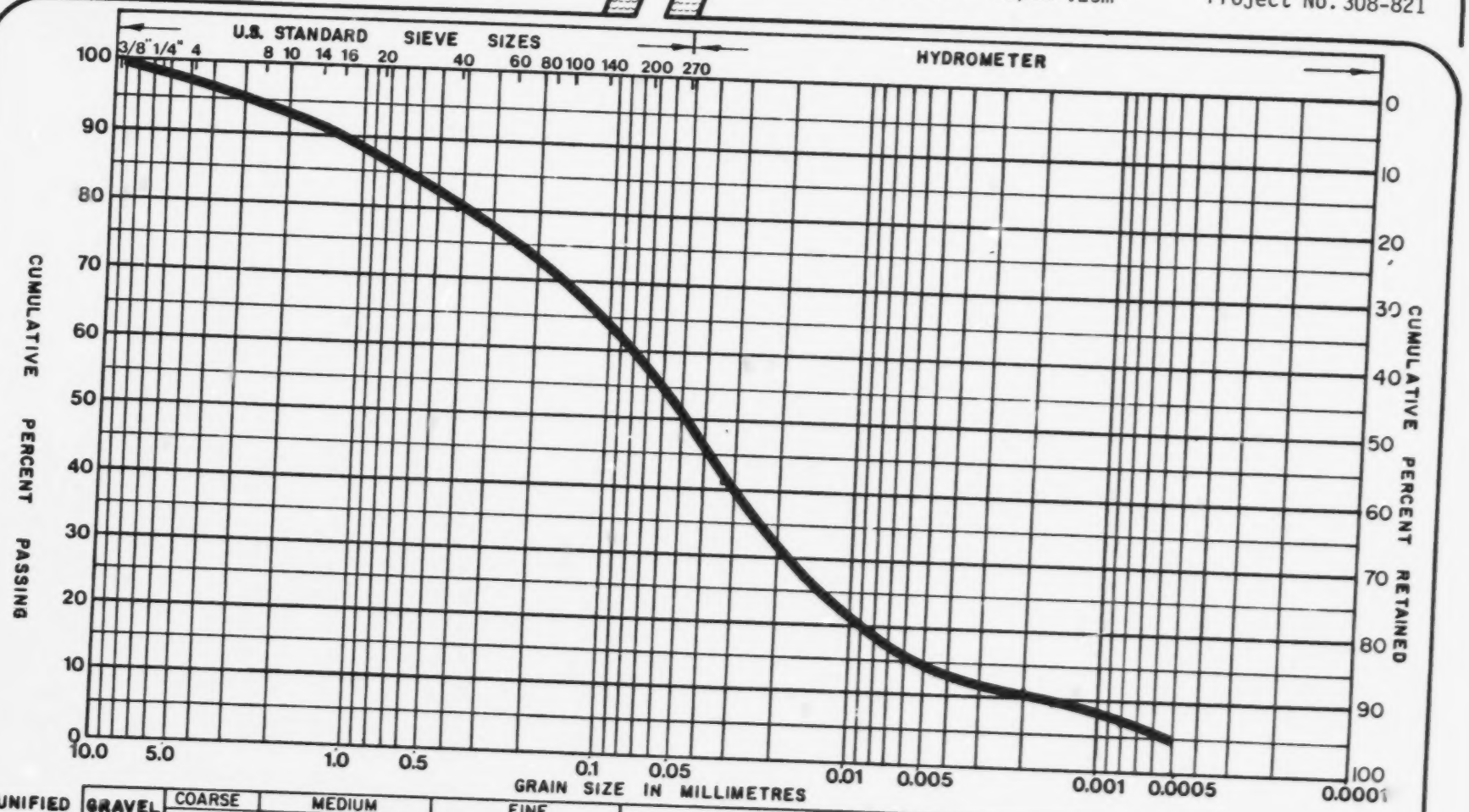
consulting engineers and hydrogeologists

GRAIN SIZE DISTRIBUTION Figure 3(a)

Test Pit # 2 depth .25m Project No. 308-821



UNIFIED	GRAVEL	COARSE	MEDIUM	FINE		SILT & CLAY					
		SAND									
M.I.T.	GRAVEL	COARSE	MEDIUM	FINE		COARSE	MEDIUM	FINE			
		SAND				SILT			CLAY		
U.S. BUREAU	GRAVEL	COARSE	MEDIUM	FINE	V. FINE	SILT		CLAY			
		SAND									

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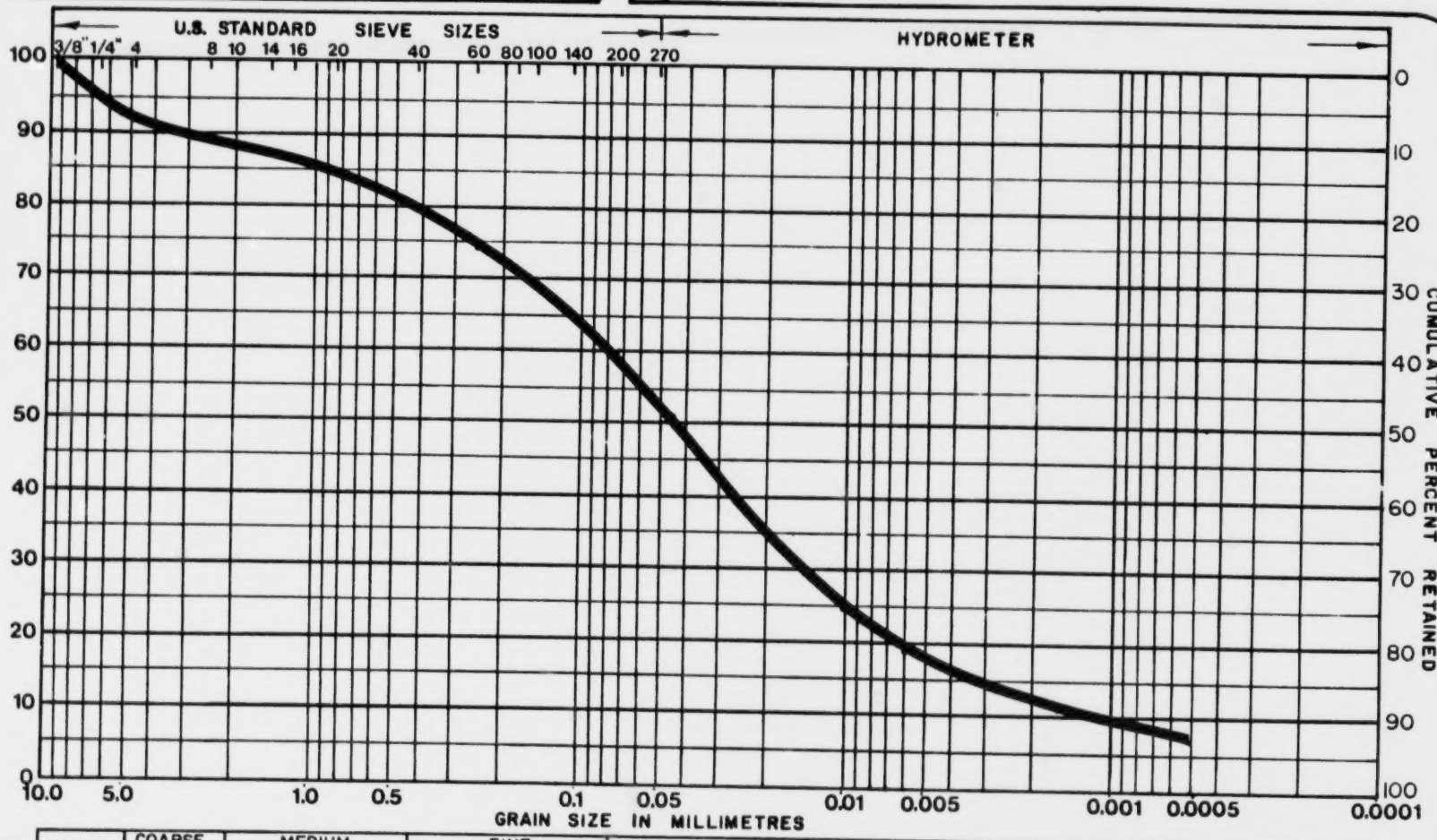
GRAIN SIZE DISTRIBUTION Figure 3(b)

Test Pit # 3 depth .42m Project No.308-821



UNIFIED	GRAVEL	COARSE	MEDIUM	FINE		SILT & CLAY					
		SAND									
M.I.T.	GRAVEL	COARSE	MEDIUM	FINE		COARSE	MEDIUM	FINE			
		SAND				SILT			CLAY		
U.S. BUREAU	GRAVEL	COARSE	MEDIUM	FINE	V.FINE	SILT			CLAY		
		SAND									

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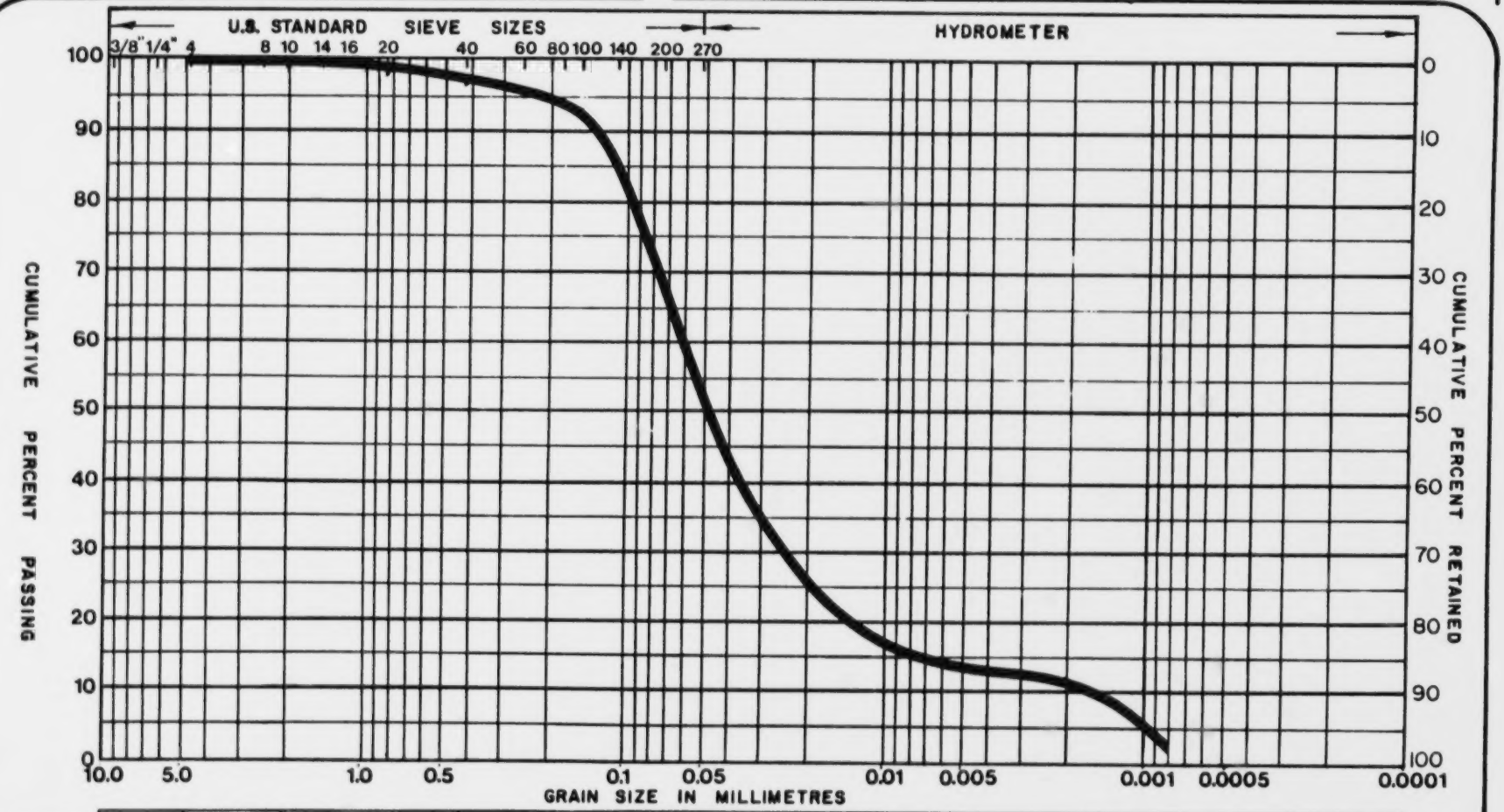
GRAIN SIZE DISTRIBUTION Figure 3(c)

Test Pit # 4 depth .12m Project No. 308-821



UNIFIED	GRAVEL	COARSE	MEDIUM	FINE		SILT & CLAY				
			SAND							
M.I.T.	GRAVEL	COARSE	MEDIUM	FINE		COARSE	MEDIUM	FINE	CLAY	
		SAND				SILT				
U.S. BUREAU	GRAVEL	COARSE	MEDIUM	FINE	V. FINE	SILT		CLAY		
		SAND								

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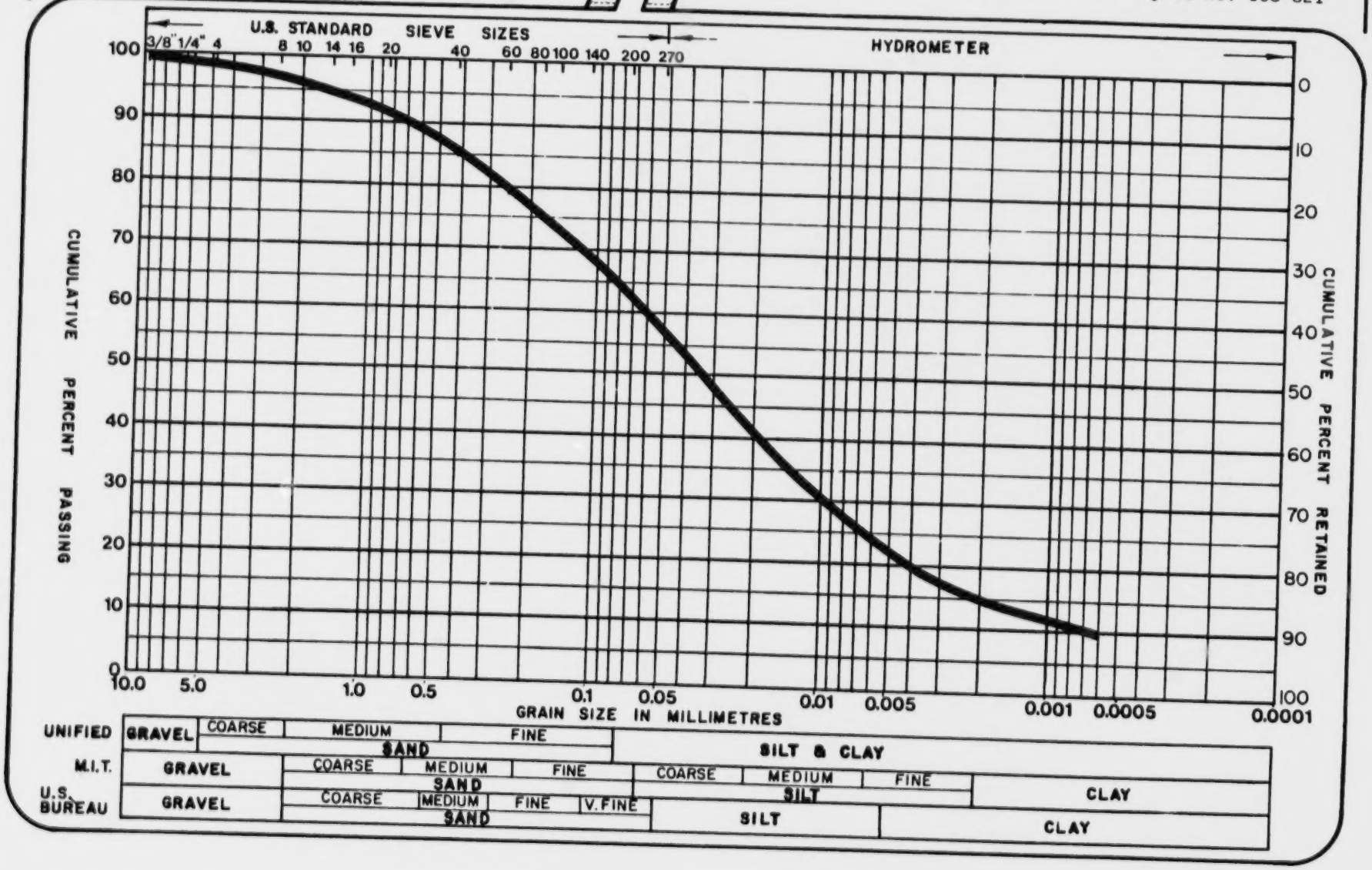
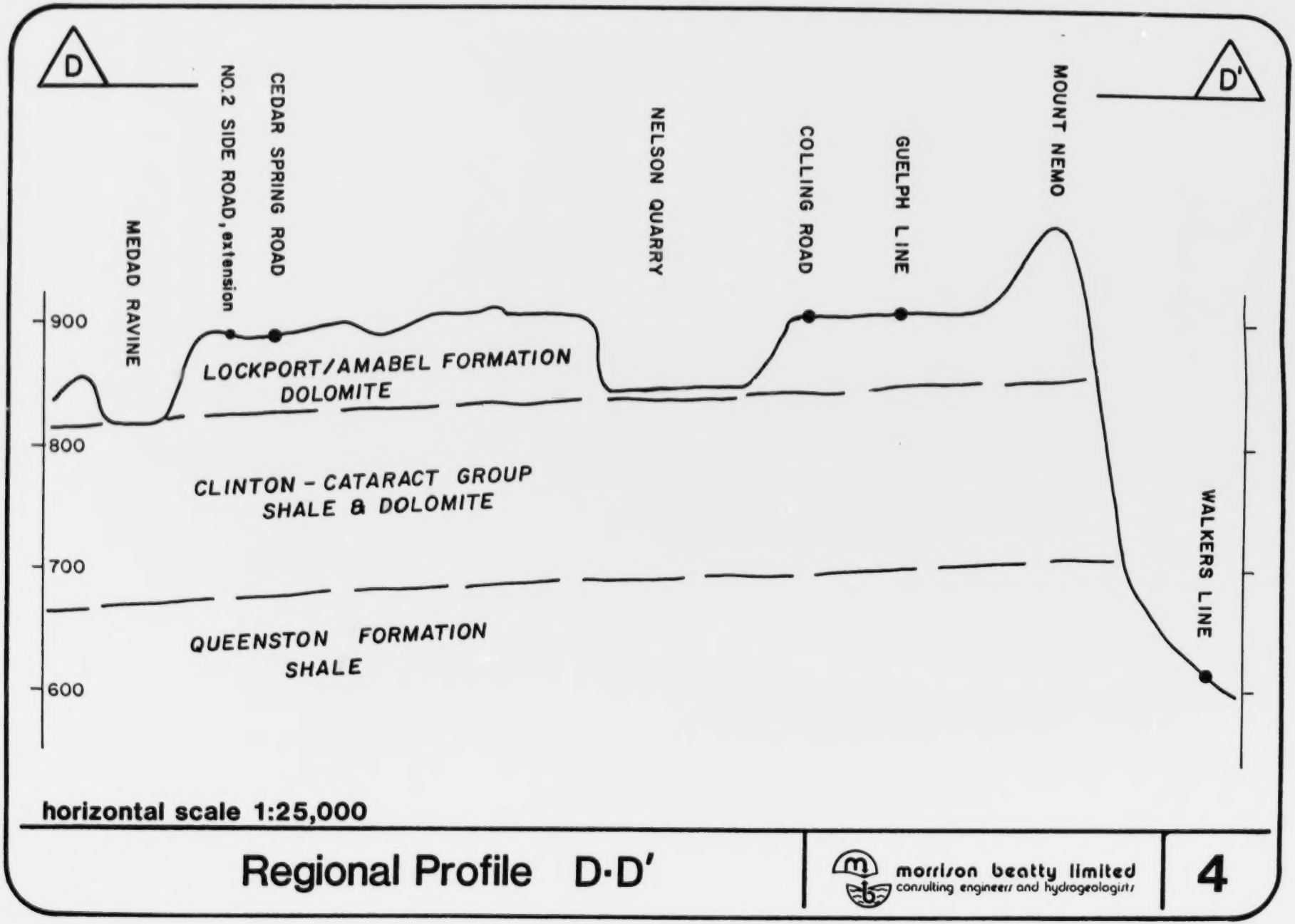
GRAIN SIZE DISTRIBUTION Figure 3(d)

Test Pit # 4 depth .42m Project No. 308-821





horizontal scale 1:25,000

Regional Profile D-D'

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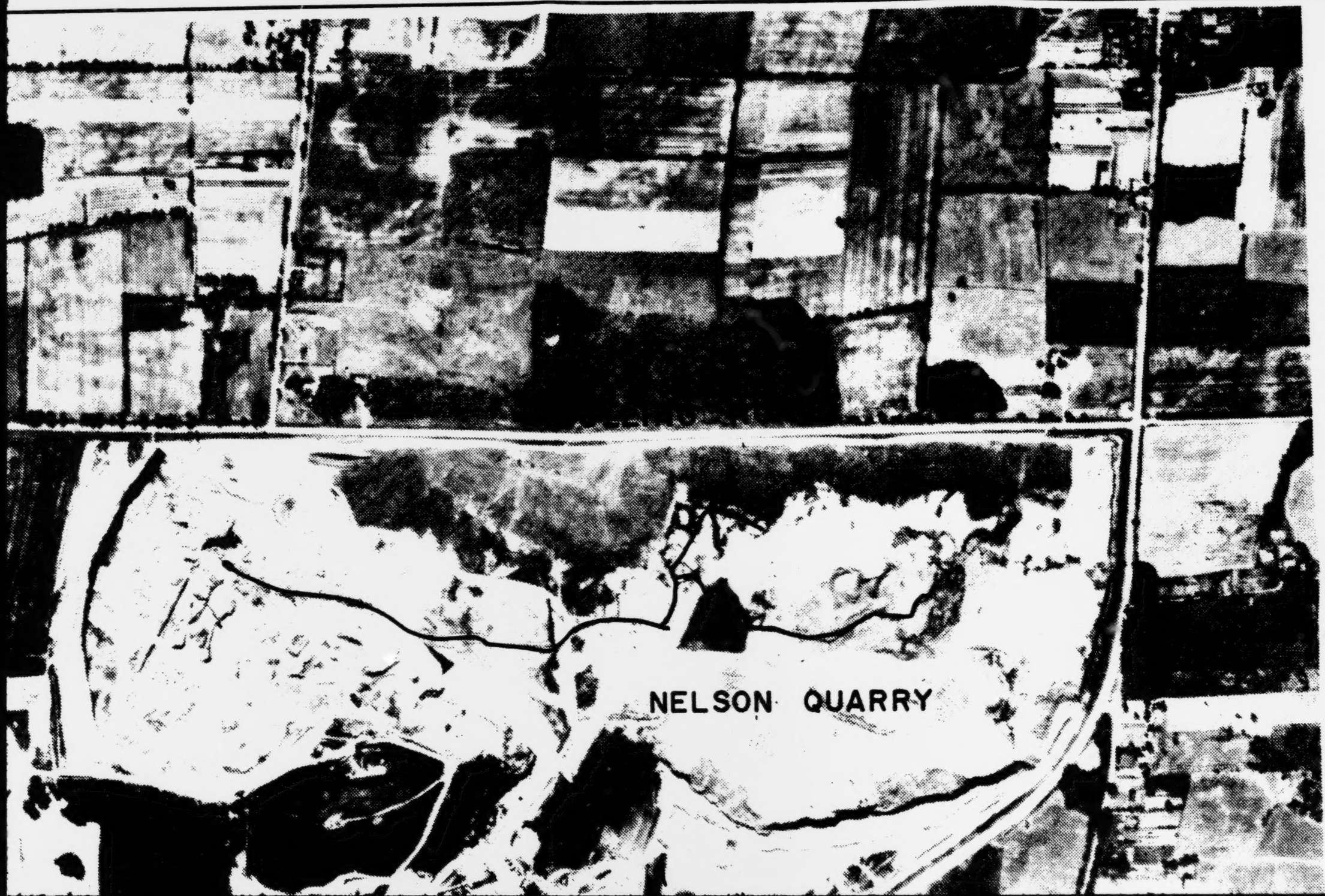
4


NELSON QUARRY

NO. 2 SIDE

ROAD

KINGS

LEGEND

STUDY AREA

WATERCOURSE

POND

SCALE 1:550

Regional Municipality of Halton

Hydrogeological Investigation at the Hamlet of Harris Gardens, Burlington

Surface Water

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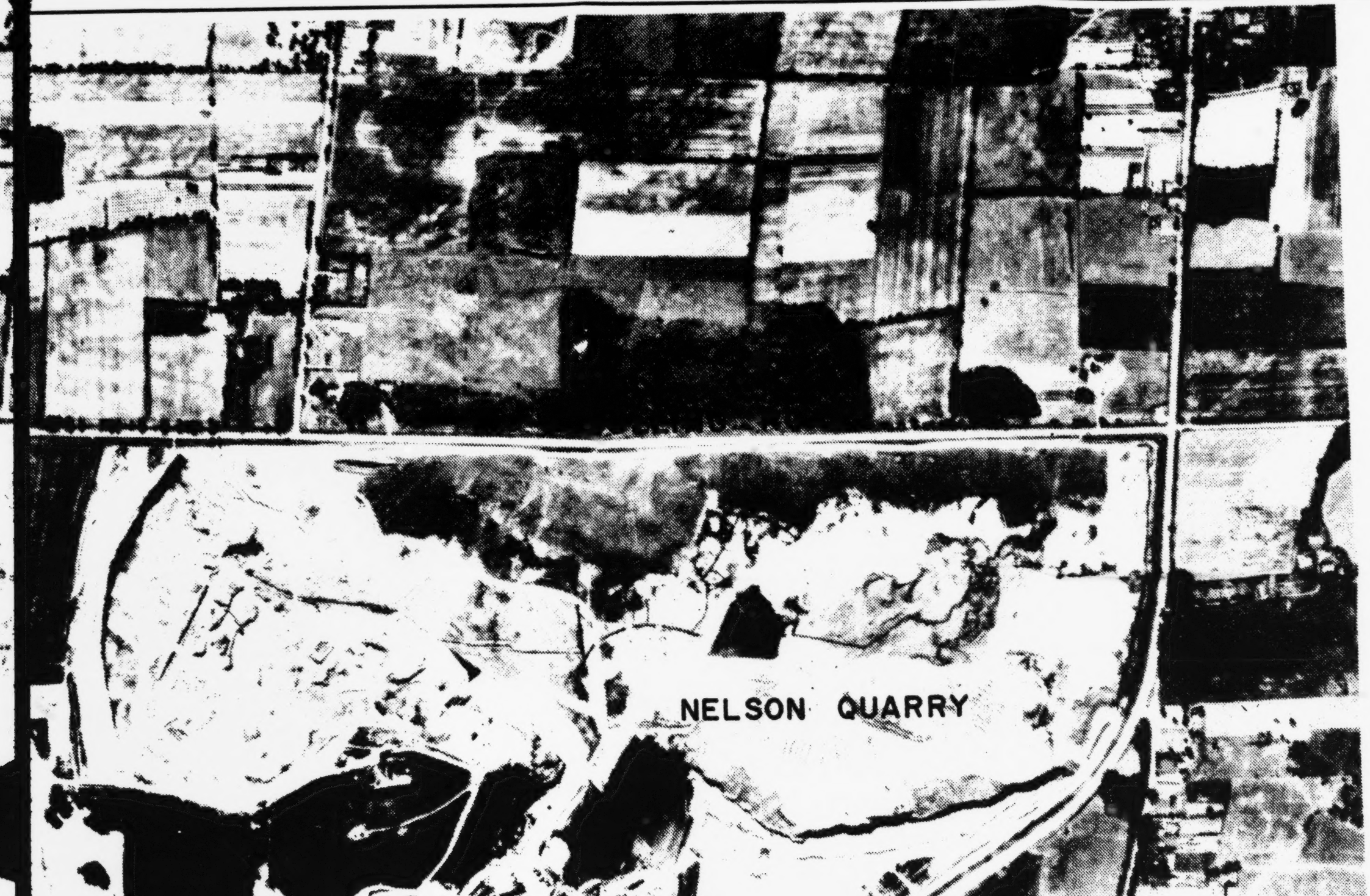
5

308-821-BAI

850

860

870


NELSON QUARRY

NO. 2 SIDE ROAD

KINGS GATE

LEGEND

STUDY AREA

860 — GROUNDWATER CONTOUR (feet)

SCALE 1:550

Regional Municipality of Halton

Hydrogeological Investigation at the Hamlet of Harris Gardens, Burlington

Groundwater

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6

308-821-BAI

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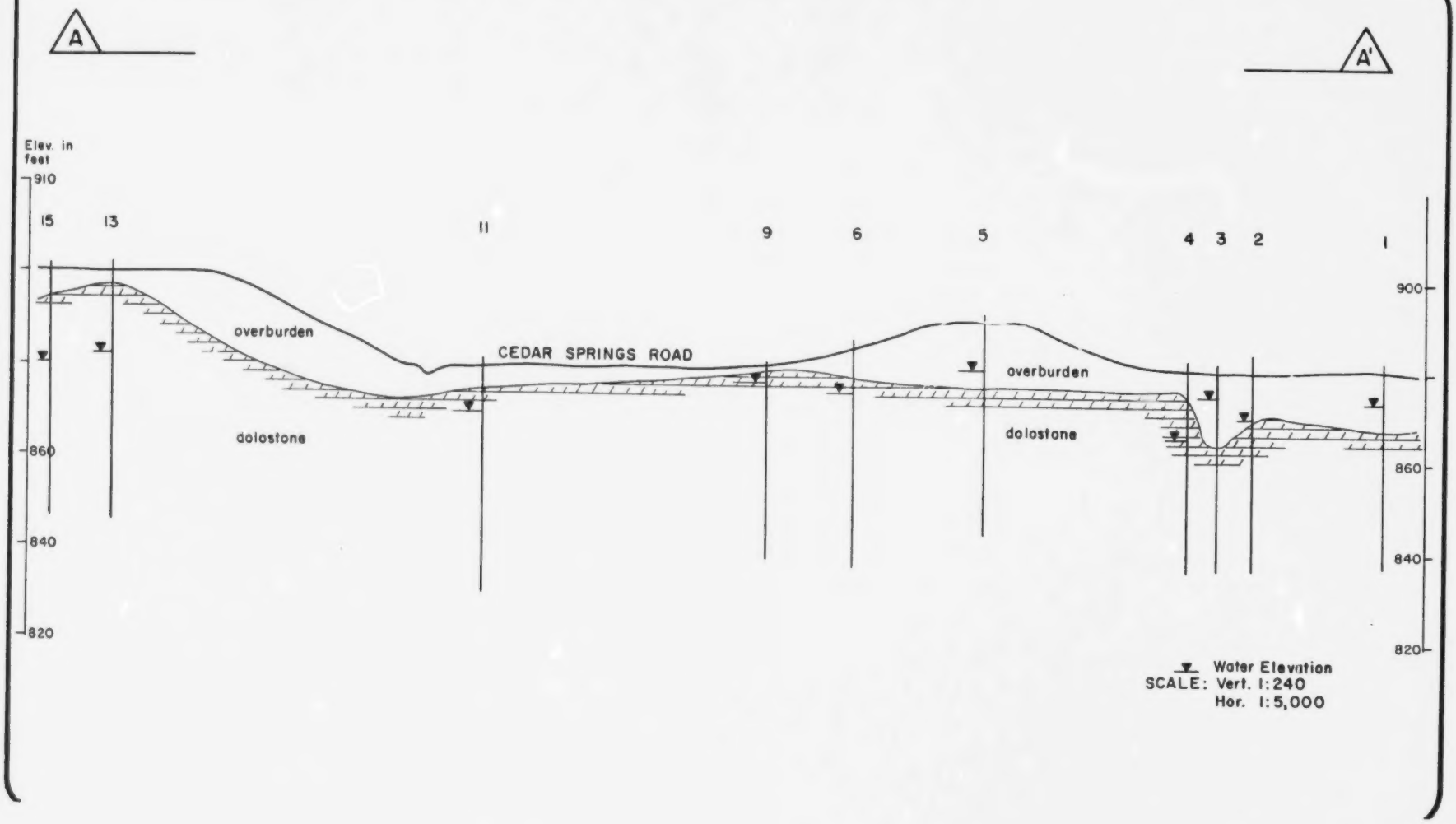
Regional Municipality of Halton
Hydrogeological Investigation at the
Hamlet of Harris Gardens, Burlington

Section A-A'

7



morrison beatty limited
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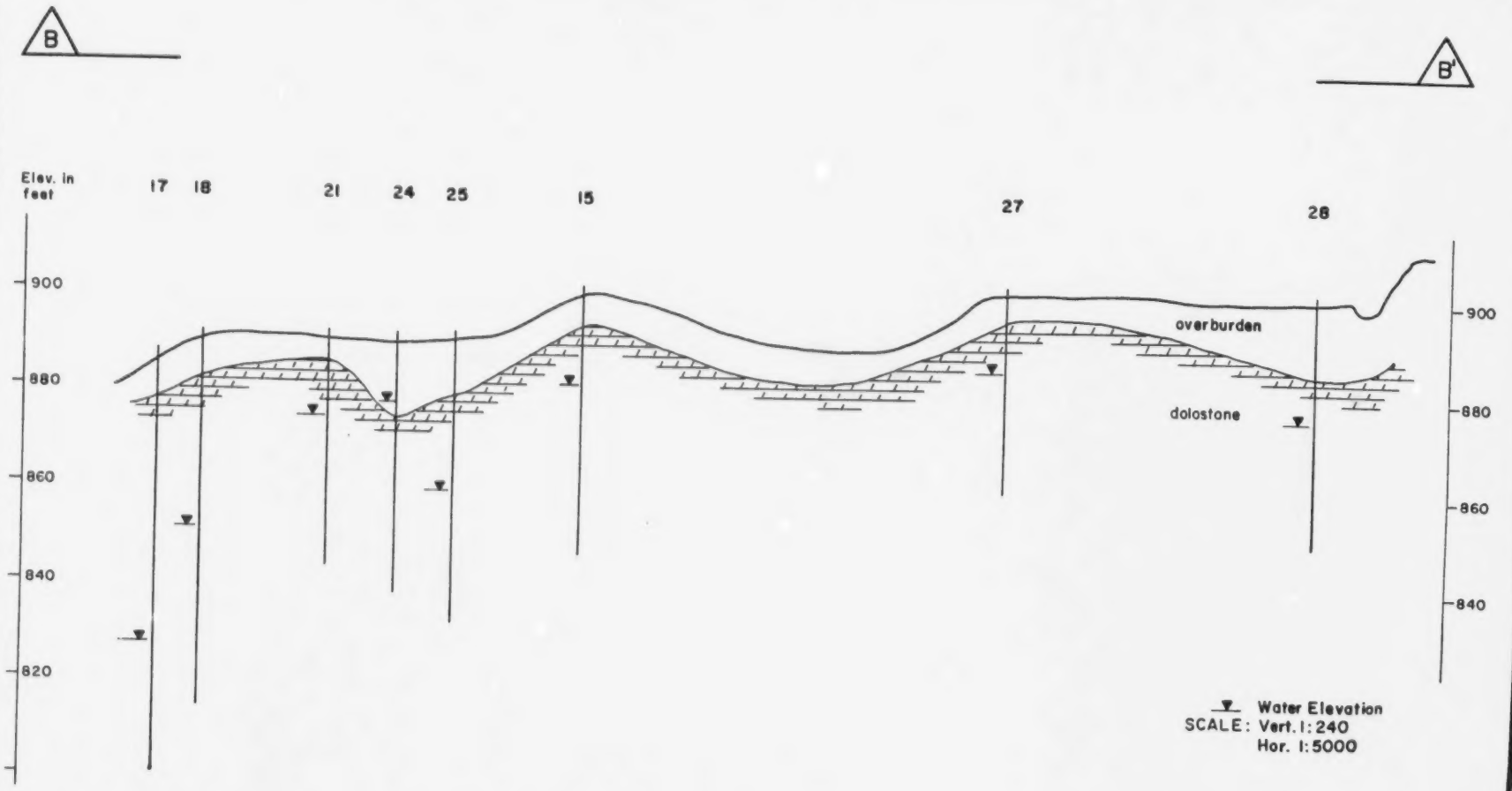
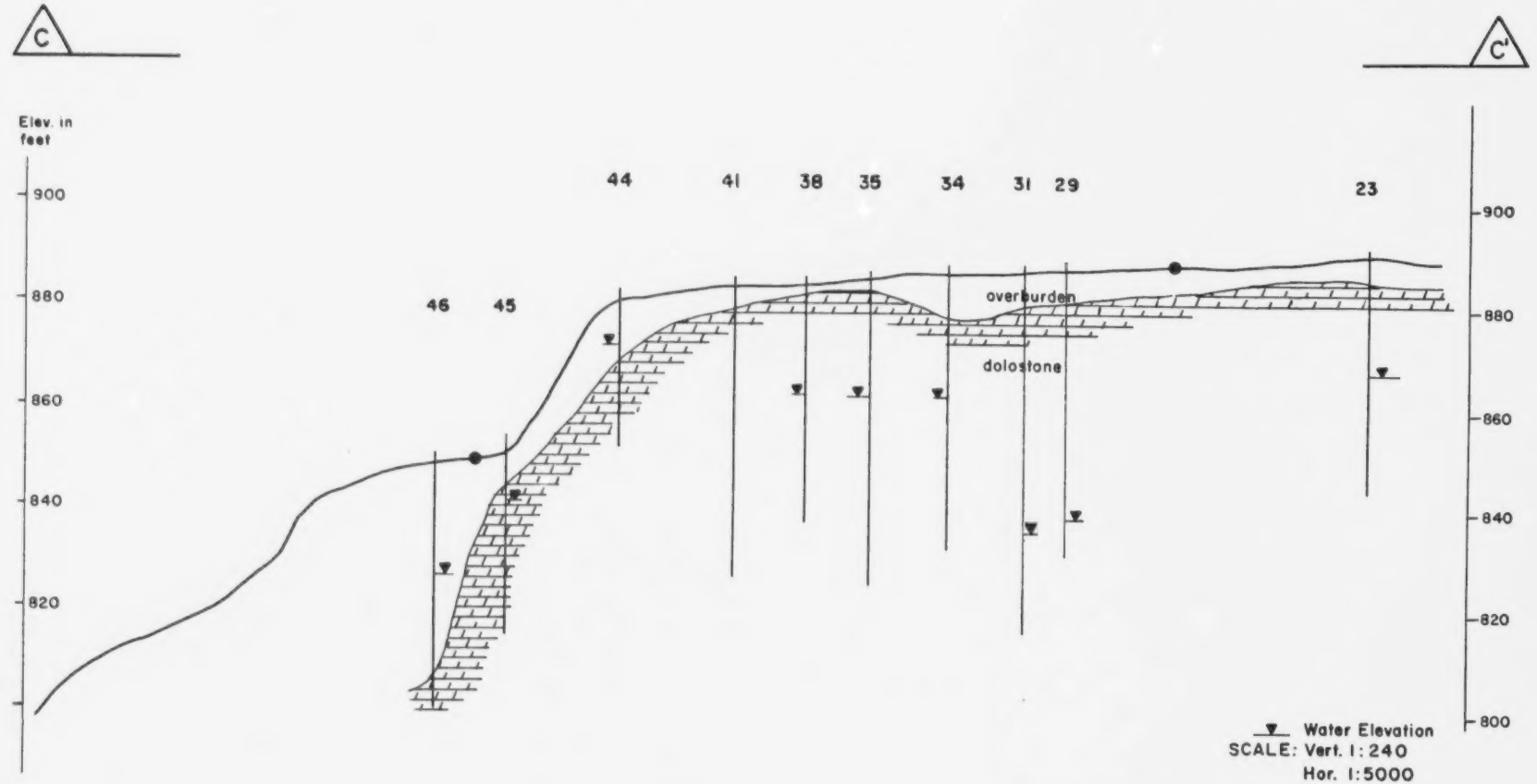
Regional Municipality of Halton
Hydrogeological Investigation at the
Hamlet of Harris Gardens, Burlington

Section B-B'

8




C
C'
Elev. in feet
900
880
860
840
820
800
46
45
44
41
38
35
34
31
29
23
overburden
dolostone
Water Elevation
SCALE: Vert. 1:240
Hor. 1:5000

APPENDIX A

TERMS OF REFERENCE

THE REGIONAL MUNICIPALITY OF HALTON

Public Works Department

P.O. BOX 7000
1151 BRONTE ROAD
OAKVILLE, ONTARIO L6J 6E1
416/827-2151

MAY 20 1982

1982 05 17

Morrison Beatty Limited
4500 Dixie Road
Unit 12A
MISSISSAUGA, Ontario
L4W 1V7

Dear Sirs:

Re: Burlington Development, Hydrogeologic Investigation
for the Hamlet of Harris Gardens, Your File P-747
Our File PR-687

I am pleased to advise you that your company has been selected to prepare the abovementioned hydrogeologic investigation, and shortly you will receive purchase requisition 71575 issued in the upset limit amount of $4,870. We would be obliged if you would ensure that future correspondence quotes both our file number and the purchase requisition number.

We look forward to your meeting with the Steering Committee at our meeting arranged for Wednesday, May 19th at 9:00 a.m. at Region Headquarters, Committee Room #2A.

Yours very truly,

H.H. Cripps, P.Eng.
Public Works Department

HHC:sw

THE REGIONAL MUNICIPALITY OF HALTON

Public Works Department

P.O. BOX 7000
1151 BRONTE ROAD
OAKVILLE, ONTARIO L6J 6E1
416/827-2151

1982 04 23

APR 27 1982

Morrison Beatty Limited
298 The West Mall
ETOBICOKE, Ontario
M9C 1C6

Attention: Mr. William D. Morrison, P.Eng.

Dear Sirs:

Re: Hydrogeological Investigation for the Hamlet of Harris Gardens in the City of Burlington.
Our File PR-687

You are invited to submit a proposal for a hydrogeological survey at the abovementioned location.

Your proposal, including your upset limit for the cost of preparing the survey, based upon the enclosed terms of reference, should be received by the Region not later than May 11, 1982.

Yours very truly,

H.H. Cripps, P.Eng.
Public Works Department

HHC:sw
Attach.

REGIONAL MUNICIPALITY OF HALTON

TERMS OF REFERENCE FOR THE PREPARATION OF A HYDROGEOLOGICAL REPORT REQUIRED IN THE PROCESSING OF DEVELOPMENT IN THE HARRIS GARDENS RURAL HAMLET IN THE CITY OF BURLINGTON

PR-687

INTRODUCTION

The purpose of the study is to determine the adequacy of long term groundwater supply and the ability of the ground to absorb sewage, to ensure that new development can proceed in the study area without detriment to existing ratepayers. The study area consists of the area within the proposed hamlet boundary, as shown upon the enclosed sketch plan, and includes any adjoining area which is of hydrogeological significance so far as the hamlet is concerned.

As the findings of this study will provide an input into the decision making process relative to future growth, it is important that information, upon which the recommendations are based, be as accurate as is practical.

TERMS OF REFERENCE

1. The study will evaluate a water supply consisting of individual private wells to serve existing residences and future development.

2. Evaluation and comment on the existing wells will be necessary and the possibility of locating a communal supply of water to serve both existing and proposed development explored. Such evaluation shall advise on a program and probable cost to locate such a communal supply.

3. Contact Regional staff, Ministry of the Environment, and existing inhabitants, if necessary, to obtain current and past individual well water quantity and quality problems. Advise how future development will impact these wells, and recommend solutions to this impact.

4. Advise the recommended minimum yield required for single family residences.

5. Advise the minimum size of lots in each area of future development with respect to groundwater availability.

6. Advise what phasing, if any, is required for future growth. One aspect of this may be that growth in certain locations may be permitted while growth in other locations may be delayed depending upon the impact that the permitted growth will have on the aquifers.

7. Recommend the necessary future test well construction and pumping, if this is required, to support findings.

8. Advise the well water quality that can be expected, as well as quantity.

9. Evaluate the possible impact of septic tank system effluent, including nitrate concentration, from proposed developments on the groundwater supply.

10. Advise on the general suitability of the ground for the construction of septic tank tilefields, and advise of any special difficulties which may be encountered.

11. Study existing relevant reports on file with the Region.

12. The following meetings shall be considered to be part of this study:

    (a) Two meetings to review the draft report.
    (b) One Public meeting.

13. The following are the number of copies of the Report that are considered to be part of this study:

    (a) Six copies of the draft report.
    (b) Thirty copies of the Final Report.

14. The draft report shall be submitted to the Region for review six weeks after authorization has been given to start the study. The Final Report will be completed three weeks after comments to the draft report have been forwarded to the consultant.

APPENDIX B

LOGS OF SELECTED WELLS

morrison beatty limited
consulting engineers and hydrogeologists
4500 dixie road, unit 12a, mississauga, ontario L4W 1V7 (416-624-9308)

TABLE

LOGS OF SELECTED WELLS

Project No. 308-821

WELL NO.	CONDENSED WELL RECORD	
1	Elev. = 870 ft Q = 8 gpm SL = 7 ft PL = bottom Date: June 1967	
	Overburden	0 - 13 ft
	Bedrock	13 - 42
	6" diameter casing Fresh water at 34 feet	
2	Elev. = 875 ft Q = 4 gpm SL = 9 ft PL = bottom Date: March 1963	
	Overburden	0 - 9 ft
	Bedrock	9 - 44
	6" diameter casing Fresh water at 26 to 39 feet	
3	Elev. = 876 ft Q = 8 gpm SL = 5.5 ft PL = bottom Date: July 1967	
	Overburden	0 - 16 ft
	Bedrock	16 - 44
	6" diameter casing Fresh water at 20 and 38 feet	

morrison beatty limited
consulting engineers and hydrogeologists
4500 dixie road, unit 12a, mississauga, ontario L4W 1V7 (416-624-9308)

TABLE

LOGS OF SELECTED WELLS

Project No. 308-821

4

Elev. = 880 ft
Q = 5 gpm
SL = 15.5 ft
PL = bottom
Date: August 1962

Overburden	0 - 5 ft
Bedrock	5 - 44

6" diameter casing
Fresh water at 37 feet

5

Elev. = 890 ft
Q = 5 gpm
SL = 10 ft
PL = bottom
Date: May 1965

Overburden	0 - 14 ft
Bedrock	14 - 46.5

6" diameter casing
Fresh water at 34 feet

6

Elev. = 890 ft
Q = 15 gpm
SL = 15 ft
PL = 42 ft
Date: June 1965

Overburden	0 - 12 ft
Bedrock	12 - 54

6" diameter casing
Fresh water at 52 feet

morrison beatty limited
consulting engineers and hydrogeologists
4500 dixie road, unit 12a, mississauga, ontario L4W 1V7 (416-624-9308)

TABLE

LOGS OF SELECTED WELLS

Project No. 308-821

7

Elev. = 890 ft
Q = 4 gpm
SL = 16 ft
PL = 42 ft
Date: October 1969

Overburden	0 - 4 ft
Bedrock	4 - 75

6" diameter casing
Fresh water at 70 feet

8

Elev. = 890 ft
Q = 3 gpm
SL = 21 ft
PL = bottom
Date: September 1963

Overburden	0 - 13 ft
Bedrock	13 - 75

6" diameter casing
Fresh water at 41 and 51 feet

9

Elev. = 885 ft
Q = 10 gpm
SL = 7 ft
PL = 40 ft
Date: 1955

Overburden	0 - 4 ft
Bedrock	4 - 46

6" diameter casing
Fresh water at 45 feet

10

Elev. = 880 ft
Q = 4 gpm
SL = 17 ft
PL = 22 ft
Date: March 1957

Overburden	0 - 8 ft
Bedrock	8 - 33.5

6" diameter casing
Fresh water at 23 feet

11

Elev. = 880 ft
Q = 6 gpm
SL = 10 ft
PL = bottom
Date: March 1964

Overburden	0 - 5 ft
Bedrock	5 - 50

6" diameter casing
Fresh water at 16, 18 and 39 feet

12

Elev. = 880 ft
Q = 7 gpm
SL = 14 ft
PL = bottom
Date: October 1966

Overburden	0 - 8 ft
Bedrock	8 - 34

6" diameter casing
Fresh water at 28 feet

13

Elev. = 906 ft
Q = 7 gpm
SL = 18 ft
PL = bottom
Date: October 1966

Overburden	0 - 3 ft
Bedrock	3 - 56

6" diameter casing
Fresh water at 46 and 54 feet

14

Elev. = 885 ft
Q = 15 gpm
SL = 12 ft
PL = 45 ft
Date: February 1968

Overburden	0 - 25 ft
Bedrock	25 - 45

6" diameter casing
Fresh water at 40 and 45 feet

15

Elev. = 890 ft
Q = 5 gpm
SL = 19 ft
PL = bottom
Date: October 1966

Overburden	0 - 7 ft
Bedrock	7 - 54

6" diameter casing
Fresh water at 36 and 48 feet

16

Elev. = 890 ft
Q = 21 gpm
SL = 22 ft
PL = 35 ft
Date: September 1958

Overburden	0 - 1.5 ft
Bedrock	1.5 - 45

6" diameter casing
Fresh water at 30 and 41 feet

17

Elev. = 890 ft
Q = 20 gpm
SL = 58 ft
PL = 58 ft
Date: October 1972

Overburden	0 - 8 ft
Bedrock	8 - 84

6" diameter casing
Fresh water at 83 feet

18

Elev. = 884 ft
Q = 20 gpm
SL = 30 ft
PL = 33 ft
Date: June 1977

Overburden	0 - 2 ft
Bedrock	2 - 70

6" diameter casing
Fresh water at 45 and 60 feet

19

Elev. = 900 ft
Q = 10 gpm
SL = 37 ft
PL = 44 ft
Date: December 1956

Overburden	0 - 5 ft
Bedrock	5 - 60

6" diameter casing
Fresh water at 55 feet

20

Elev. = 900 ft
Q = 12 gpm
SL = 25 ft
PL = 29 ft
Date: June 1957

Overburden	0 - 9 ft
Bedrock	9 - 49

6" diameter casing
Fresh water at 42 feet

21

Elev. = 900 ft
Q = 29 gpm
SL = 15.5 ft
PL = 26 ft
Date: May 1956

Overburden	0 - 4.5 ft
Bedrock	4.5 - 47

6" diameter casing
Fresh water at 33 and 46 feet

22

Elev. = 886 ft
Q = 20 gpm
SL = 23 ft
PL = 31 ft
Date: June 1976

Overburden	0 - 5 ft
Bedrock	5 - 58

6" diameter casing
Fresh water at 50 and 57 feet

23

Elev. = 900 ft
Q = 23 gpm
SL = 22 ft
PL = 31 ft
Date: September 1957

Overburden	0 - 2 ft
Bedrock	2 - 46

6" diameter casing
Fresh water at 43 feet

24

Elev. = 887 ft
Q = 3 gpm
SL = 12 ft
PL = bottom
Date: July 1967

Overburden	0 - 15 ft
Bedrock	15 - 52

6" diameter casing
Fresh water at 32 and 40 feet

25

Elev. = 900 ft
Q = 7 gpm
SL = 31 ft
PL = 40 ft
Date: November 1959

Overburden	0 - 7 ft
Bedrock	7 - 58

6" diameter casing
Fresh water at 42 feet

26

Elev. = 890 ft
Q = 12 gpm
SL = 17 ft
PL = 41 ft
Date: July 1963

Overburden	0 - 10 ft
Bedrock	10 - 58

6" diameter casing
Fresh water at 36 and 53 feet

27

Elev. = 885 ft
Q = 6 gpm
SL = 12 ft
PL = 37 ft
Date: November 1963

Overburden	0 - 5 ft
Bedrock	5 - 47

6" diameter casing
Fresh water at 45 feet

28

Elev. = 900 ft
Q = 12 gpm
SL = 25 ft
PL = 45 ft
Date: August 1978

Overburden	0 - 16 ft
Bedrock	16 - 50

6" diameter casing
Fresh water at 42 and 47 feet

29

Elev. = 900 ft
Q = 10 gpm
SL = 38 ft
PL = 38 ft
Date: July 1959

Overburden	0 - 2 ft
Bedrock	2 - 56.5

6" diameter casing
Fresh water at 40 and 50 feet

30

Elev. = 900 ft
Q = 10 gpm
SL = 38 ft
PL = 38 ft
Date: August 1959

Overburden	0 - 4 ft
Bedrock	4 - 56

6" diameter casing
Fresh water at 40 feet

31

Elev. = 886 ft
Q = 20 gpm
SL = 37 ft
PL = 45 ft
Date: August 1976

Overburden	0 - 1 ft
Bedrock	1 - 68

6" diameter casing
Fresh water at 48 and 65 feet

32

Elev. = 808 ft
Q = 1 gpm
SL = 49 ft
PL = 49 ft
Date: June 1977

Overburden	0 - 3 ft
Bedrock	3 - 70

6" diameter casing
Fresh water at 56, 59 and 70 feet

33

Elev. = 880 ft
Q = 12 gpm
SL = 36 ft
PL = 43 ft
Date: December 1967

Overburden	0 - 3 ft
Bedrock	3 - 55

6" diameter casing
Fresh water at 43 feet

34

Elev. = 890 ft
Q = 12 gpm
SL = 24 ft
PL = 29 ft
Date: June 1959

Overburden	0 - 10 ft
Bedrock	10 - 53.5

6" diameter casing
Fresh water at 45 feet

35

Elev. = 882 ft
Q = 20 gpm
SL = 23 ft
PL = 30 ft
Date: March 1969

Overburden	0 - 2 ft
Bedrock	2 - 59.5

6" diameter casing
Fresh water at 38 and 57 feet

36

Elev. = 880 ft
Q = 12 gpm
SL = 32 ft
PL = 35 ft
Date: August 1973

Overburden	0 - 5 ft
Bedrock	5 - 58

6" diameter casing
Fresh water at 53 feet

37

Elev. = 876 ft
Q = 10 gpm
SL = 27 ft
PL = 42 ft
Date: March 1964

Overburden	0 - 2 ft
Bedrock	2 - 64.5

6" diameter casing
Fresh water at 61 feet

38

Elev. = 880 ft
Q = 12 gpm
SL = 36 ft
PL = 58 ft
Date: November 1967

Overburden	0 - 22 ft
Bedrock	22 - 70

6" diameter casing
Fresh water at 31 and 64 feet

39

Elev. = 880 ft
Q = 30 gpm
SL = 28 ft
PL = 37 ft
Date: July 1965

Overburden	0 - 6 ft
Bedrock	6 - 55

6" diameter casing
Fresh water at 49 and 54 feet

40

Elev. = 890 ft
Q = 10 gpm
SL = 23 ft
PL = 40 ft
Date: December 1963

Overburden	0 - 4.5 ft
Bedrock	4.5 - 46

6" diameter casing
Fresh water at 43 feet

41

Elev. = 879 ft
Q = 4.5 gpm
SL = 22 ft
PL = bottom
Date: December 1965

Overburden	0 - 4 ft
Bedrock	4 - 56

6" diameter casing
Fresh water at 41 feet

42

Elev. = 884 ft
Q = 10 gpm
SL = 40.5 ft
PL = 49 ft
Date: July 1963

Overburden	0 - 4 ft
Bedrock	4 - 57

6" diameter casing
Fresh water at 52 feet

43

Elev. = 880 ft
Q = 9 gpm
SL = 33 ft
PL = bottom
Date: June 1966

Overburden	0 - 3 ft
Bedrock	3 - 59

6" diameter casing
Fresh water at 41 feet

44

Elev. = 890 ft
Q = 15 gpm
SL = 18 ft
PL = 35 ft
Date: June 1960

Overburden	0 - 8 ft
Bedrock	8 - 57

6" diameter casing
Fresh water at 37 feet

45

Elev. = 845 ft
Q = 12 gpm
SL = 3 ft
PL = 24 ft
Date: September 1973

Overburden	0 - 8 ft
Bedrock	8 - 30

6" diameter casing
Fresh water at 11 and 28 feet

46

Elev. = 832 ft
Q = 10 gpm
SL = 29 ft
PL = 32 ft
Date: September 1963

Sand & Boulders	0 - 49 ft
Gravel	49 - 54

6" diameter casing
Fresh water at 21, 47 and 54 feet

APPENDIX C

WATER CHEMICAL ANALYSES

morrison beatty limited
consulting engineers and hydrogeologists
4500 dixie road, unit 12a, mississauga, ontario L4W 1V7 (416-624-9308)

WATER CHEMICAL ANALYSES

Project No. 308-821

Sample No.	Chemical Parameter: Total Hardness	Chloride	Sulphate	Total Iron	Total Nitrates	pH
1001	390.4	12.8	78	.02 t	12.0	7.88
1002	450.8	63.0	125	.05	0.1<t	8.19
1003	486.8	342.8	67.5	.05	1.0	7.97
1004	348.0	150.6	74.5	.02<t	0.9	7.98
1005	429.2	72.0	117.0	.02<t	3.3	8.14
1006	470.0	242.6	70	.01<t	4.5	7.88
1007	411.6	153.2	69.5	.03<t	3.8	8.06
1008	406.0	144	70	.02<t	3.0	7.88
1009	419.6	117.8	54	.02<t	7.6	7.8

all parameters recorded in mg/L except pH

t = 90% chance of being zero

APPENDIX D

BACTERIOLOGICAL ANALYSES

morrison beatty limited
consulting engineers and hydrogeologists
4500 dixie road, unit 12a, mississauga, ontario L4W 1V7 (416-624-9309)

BACTERIOLOGICAL ANALYSES

Project No. 308-821

SAMPLE NO.	COLIFORM COUNT PER 100 ml	
	Total	Faecal
1	30	0
2	6	3
3	< 2	0
4	< 2	0
5	150	0
6	< 2	0
7	< 2	0
8	< 2	0
9	120	12
10	< 2	0
11	30	0
12	< 2	0
13	< 2	0
14	2	0
15	28	1
16	< 2	0
17	18	0
18	< 2	0
19	24	0
20	10	0
21	2	0
22	< 2	0
23	8	0
24	< 2	0
25	6	0
26	140	> 60
27	130	55

POOR

QUALITY

ORIGINAL